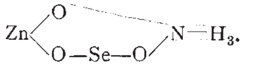
from an exhaustive examination of the record books, will be commenced. In the past year sixty-one sheets were scored under the superintendence of the Trigonometrical Assistant, each representing an area of 13·6 miles by 8·8 miles, and containing in all 1687 fixed stations. He has also prepared an elaborate map of the island, showing sheet line distances.

THE Report for the past year on the mining and mineral statistics of Canada, by Mr. H. P. Brumell, of the Dominion Geological Survey, has been received in this country. The total value of the production of minerals of all kinds for the year was $16,500,000—an increase of 1,500,000 as compared with 1887, and 6,000,000 against 1886. Coal is the largest mineral product of the Dominion, the value of last year's yield amounting to $1,098,610, as against $1,178,637, in 1887, and $1,330,442 in 1886. The decrease in the yield of gold has been anticipated for some years. Copper was mined to the value of $667,543, and these figures will in all probability be doubled this year, in view of the rapid development of the Sudbury and Lake Superior Mines. The asbestos yield amounted to $255,007, and the phosphate production shows an appreciable increase.

THE Smithsonian Institution has issued a "Preliminary Catalogue of the Shell-bearing Marine Mollusks and Brachiopods of the South-Eastern coast of the United States," by W. Healey Dall. The volume includes admirable illustrations of many species.

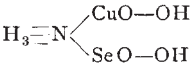
WE have received the sixty-second part of the first division of the "Encyclopædie der Wissenschaften," and the fifty-fourth and fifty-fifth parts of the second division of the same work (Breslau, Trewendt). The first of these three parts is a contribution to the hand-book of botany included in this Encyclopædia; the second and third conclude the seventh volume of the Encyclopædia's Dictionary of Chemistry.

A NEW series of well crystallized salts, ammoniacal selenites, are described by M. Boutzoureano in the current number of the *Annales de Chimie et de Physique*. Most normal selenites are found to be readily soluble in strong ammonia, and the solutions on evaporation either in the air or *in vacuo* deposit crystals of ammoniacal selenites. Four of these interesting salts have been studied in detail, those of zinc, cadmium, copper, and silver. Ammoniacal zinc selenite, $ZnO.SeO_2.NH_3$, is obtained by dissolving neutral zinc selenite, $ZnO.SeO_2$, a salt which crystallizes in rhombic prisms, in strong ammonia at the ordinary temperature. On allowing the solution to spontaneously evaporate, crystals of the ammoniacal salt are deposited in the form of fine long prisms capped by domo-prisms belonging to the rhombic system. The crystals are insoluble in water, which appears to exert no action whatever upon them. They are also unchanged by heating to 100° C., but when heated in a sealed tube the selenious oxide is reduced by the hydrogen of the ammonia with evolution of water vapour and sublimation of selenium. On ignition they are completely converted to zinc oxide. Acids readily dissolve the crystals even when largely diluted with water. The constitution of the salt appears to be



$$Zn\begin{cases}O \cdots\cdots\cdots\cdots \\ O{-}Se{-}O\end{cases} N{\equiv}H_3.$$

Normal cadmium selenite, $CdO.SeO_2$, is also soluble in ammonia, and the solution leaves on evaporation white rhombic crystals of an ammoniacal cadmium salt, $CdO.SeO_2.NH_3$, analogous to the zinc salt. These crystals are likewise unattacked by water, and are stable at 100°. They also give off water and vapour of selenium when heated in a sealed tube. The most beautiful salt of the series, however, is the ammoniacal copper selenite. Copper forms a normal selenite of the composition $3(CuO.SeO_2).H_2O$, which crystallizes in small green monoclinic crystals. These crystals readily dissolve in ammonia, forming a deep bluish-violet solution, which on slow evaporation in the air yields magnificent blue crystals of the ammoniacal salt belonging to the triclinic system. The salt is found to contain one molecule of water, and is represented by the formula $CuO.SeO_2.NH_3.H_2O$, the constitution being probably more nearly expressed in the following manner,



$$H_3{\equiv}N\begin{cases}CuO{-}OH \\ SeO{-}OH\end{cases}$$

Unfortunately these fine crystals soon alter in contact with air, losing their water and ammonia and becoming covered with a green coating of basic copper selenite. Water has apparently no action upon them, but in reality there is a surface action, the coating of basic selenite thereby formed preventing any further decomposition. In a similar manner silver is found to form an ammoniacal selenite, the crystals belonging, like those of the copper salt, to the triclinic system. They are anhydrous, $Ag_2O.SeO_2.NH_3$, and are blackened by exposure to sunlight. Thus the series is seen to be a very well defined one, the members consisting of normal selenites combined with one molecule of NH_3, generally anhydrous, but occasionally, as in case of the copper salt, containing water of crystallization.

THE additions to the Zoological Society's Gardens during the past week include a Barbary Ape (*Macacus inuus* ♂), a Saker Falcon (*Falco sacer*) from North Africa, presented by Captain Augustus Kent; a Malbrouck Monkey (*Cercopithecus cynosurus* ♂) from West Africa, presented by Dr. Messiter Lang; two Fieldfares (*Turdus pilaris*), British, presented by Mr. J. Young, F.Z.S.; a Golden-naped Amazon (*Chrysotis auripalliata*) from Central America, purchased; a Molucca Deer (*Cervus moluccensis*), born in the Menagerie.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m., November 28 = 2h. 31m. 57s.

Name.	Mag	Colour.	R.A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G. C. 575	—	—	2 33 30	+38 19
(2) ρ Arietis	6	Yellowish-red.	2 49 37	+17 53
(3) ξ′ Ceti	5	Yellowish-white.	2 7 12	+ 8 20
(4) γ Ceti	3	White.	2 37 36	+ 2 46
(5) D M + 57° 647 ...	9	Reddish-yellow.	2 42 51	+57 24
(6) R Ursæ Minoris ...	Var.	Reddish-yellow.	16 31 18	+37 34
(7) V Geminorum ...	Var.	—	7 16 59	+13 18

Remarks.

(1) Sir John Herschel describes this nebula as: Very bright, very large, very much extended, very much brighter in the middle. Dr. Huggins noted, in 1866, that the spectrum was continuous, but pointed out in his remarks that this was not to be understood to mean more than that, when the slit was made as narrow as the feeble light permitted, the spectrum was not resolved into bright lines. Further observations are therefore required, for it may be that slight brightenings in the apparently continuous spectrum were overlooked in the early observations. The case of the nebula in Andromeda indicates that, in some of the nebulæ of this class, bright carbon flutings may be superposed upon the continuous spectrum, in which case they will not be very obvious. The carbon flutings seen in the spectrum of the flame of a spirit-lamp are convenient for comparison in an observation of this nature.

(2) This is a typical star of Group II. Dunér describes it as superb and brilliantly developed, the bands 1–9 being perfectly visible. The star therefore affords an opportunity of observing the bright carbon flutings and checking their positions. If they

are very bright, the compound structure, as seen in the spectrum of a spirit-lamp or the base of a candle-flame, may be looked for. The star falls in species 9 of the subdivision of the group, and is accordingly of about mean condensation. Dark metallic lines will probably be found to make their appearance about this temperature, and the presence or absence of *b*, D, or other lines should therefore be noted.

(3) Vogel classes this with stars of the solar type, but is doubtful whether it does not belong to Group II. It is most likely that it is at an intermediate stage—either a late stage of Group II. or an early stage of Group III. There are evidently traces of some of the dark flutings, and it is suggested that the distinguishing numbers of these and the relative intensities of the lines should be noted. The observations made by Prof. Lockyer and myself seem to indicate that the bands in the red are the most persistent as the temperature increases.

(4) According to Gothard this is a star of Group IV., and the usual observations are required.

(5) This is classed with stars of Group VI. in Dunér's catalogue, but it is stated that the type of spectrum is rather doubtful. Like the star given last week, it may possibly be intermediate between Groups V. and VI., and similar observations are suggested.

(6) This is a variable star which will be at its maximum on November 30. Gore gives the period as 281·2 days, and the range as 8 at maximum to < 11·5 at minimum. The spectrum is of the Group II. type, and the suggestions made for the observation of R Tauri (see p. 68) apply equally in this case. It may be further suggested that the spectrum be observed for some time after the maximum, special attention being given to the fading out of the carbon fluting in the green (517, a little more refrangible than *b*) relatively to the other bright spaces.

(7) Gore gives the period of this variable (maximum on December 4) as 276 days, and the range as 8·6 to < 13·5. The spectrum and colour have not yet, so far as I know, been recorded, and midnight observers may therefore take advantage of the approaching maximum.

A. FOWLER.

THE TOTAL SOLAR ECLIPSE OF 1886.—The report of the observations of the total solar eclipse of August 29, 1886, made at the Island of Carriacou by the Rev. S. J. Perry, has been published. The two main questions that required spectroscopic observations to answer them were:—(1) Does the absorption, which produces the Fraunhofer lines, take place mainly in a single layer of the solar atmosphere, or in concentric layers? (2) Does carbon exist in the corona? With respect to the first point, Father Perry thinks that the differences in the length of the lines which he observed before totality on the less refrangible side of *b* seems somewhat to strengthen the view that the selective absorption takes place in concentric layers. During totality a search was made for the two principal bands of the carbon spectrum. The part of the spectrum observed was from about *b* to λ560, but no trace was seen of the carbon bands. Father Perry, however, suggests that perhaps the intensity of the carbon spectrum may vary in each eclipse, and may have some direct connection with the amount of solar activity. Some sketches of the coronal streamers are appended to this report.

Mr. H. H. Turner's report of the observations of the same eclipse, made in the Island of Grenada, has also been received. The following is a list of the lines seen and the order in which they appeared:—

h.	m.	s.		
7	7	45	...	F line appeared.
7	8	55	...	4923 appeared; very short.
7	11	30	...	4923 and 4933. Immediately after, many lines appeared.
7	12	0	...	Totality.
7	20	50	...	Only F; 4923 and 4933 visible at times.
7	21	45	...	4923 still suspected, and 4956.
7	22	28	...	4956; certainly visible.
7	24	42	...	No line visible.

It will be seen that to some extent these observations lead to the same conclusion as that arrived at by Father Perry.

The corona was examined with a view to the detection of currents, but with a negative result.

PALERMO OBSERVATORY.—The fourth volume of observations made at Palermo has been issued by Prof. Riccò, and covers the period 1884-88. The observations of sun-spots during 1885 show that the limiting latitude in which the phenomena occurred were + 25° and − 30°. Two maxima are indicated by the curve of distribution that has been plotted, both extending from about 10° to 15° north and south of the equator, but the number of spots that have been observed in the latter hemisphere considerably exceeds that observed in the former. The minimum which occurs between these two maxima is in a latitude slightly north of the equator. Generally speaking, faculæ appear to have been equally distributed over the sun's surface. The spectroscopic observations that have been made of solar prominences in different latitudes demonstrate that the reversal of the coronal line 1474K and *b* was considerably more frequent a little to the south of the equator than in any other latitude, and was contained within the limits + 30° to − 30°, following somewhat the same line of distribution as that of spots.

Prof. Riccò has included some fine sunset observations made after the eruption at Krakatão, which support the view that, to a great extent, they were due to the suspension of volcanic dust in the atmosphere. A lengthy series of meteorological measurements, some observation of Nova Orionis, Nova Andromedæ, and various comets, are also contained in this publication.

THE VARIABLE STAR Y CYGNI.—The irregularities before observed in the period of this star have been verified by Mr. Chandler's more recent observations (*Astronomical Journal*, No. 204, October 1889). He finds that the period of the star, which increased by nearly two minutes during 1887 and 1888, is now decreasing at a similarly surprising rate. The reversal appears to have occurred about the middle of 1888, and the average value for the last twelve months has been about 1d. 11h. 56·7m. Assuming this average value for the period of the star, an ephemeris is subjoined. Only alternate minima are given.

Minima of Y Cygni. G.M.T.

	1889.	d.	h.	m.			1890.	d.	h.	m.
727	Dec.	2	12	38	...	747	Jan.	1	11	32·0
729	,,	5	12	31·4	...	749	,,	4	11	25·4
731	,,	8	12	24·8	...	751	,,	7	11	18·8
733	,,	11	12	18·2	...	753	,,	10	11	12·2
735	,,	14	12	11·6	...	755	,,	13	11	5·6
737	,,	17	12	5·0	...	757	,,	16	10	59·0
739	,,	20	11	58·4	...	759	,,	19	10	52·4
741	,,	23	11	51·8	...	761	,,	22	10	45·8
743	,,	26	11	45·2						
745	,,	29	11	38·6						

PARAMATTA OBSERVATORY.—The Government Astronomer at this Observatory, Mr. H. C. Russell, F.R.S., has collected and arranged in a concise form the history of what has been done in New South Wales for astronomy and meteorology since 1778. The paper may be found in the Proceedings of the Australasian Association for the Advancement of Science, Sydney, 1888, p. 45.

MINOR PLANET 282.—This planet, discovered by M. Charlois, January 28, 1889, has received the name of Clorinde.

COMET DAVIDSON (*e* 1889).—Ephemeris for Greenwich time:—

1889.		R.A.				Decl.	
		h.	m.	s.		°	′
Nov. 29·5	...	19	17	21	...	+ 38	56
Dec. 1·5	...	,,	21	41	...	39	10
,, 3·5	...	,,	26	3	...	,,	25
,, 5·5	...	,,	30	25	...	,,	40

A NEW VARIABLE STAR IN HYDRA.—Mr. Edwin F. Sawyer, in the *Astronomical Journal*, No. 204, gives observations demonstrating the variability of the star 358 (U.A.) Hydræ, R.A. 13h. 41m. 59s., Decl. −27° 44′·5 (1875·0). An inspection of the observations that had previously been made of the magnitude of this star indicates fluctuations of about one unit, viz. 7m. to 8m., and the period would appear to be about one year. The star is quite red.

SUN-SPOTS IN HIGH SOUTHERN LATITUDES.—The Rev. S. J. Perry read a paper under this title at the meeting of the Royal Astronomical Society on November 8, in which he drew attention to some remarkable instances which have recently occurred of the appearance of sun-spots at a great distance from the equator. These took place on June 5, June 30, October 8, and October 10 respectively; that of June 30 being especially interesting, as the spot seen on that occasion attained a latitude of 40°, a circumstance for which there are only a very few recorded precedents. Besides these spots mentioned by Father Perry some much larger groups have also been seen at a less but still considerable distance from the equator. Thus on July 26 and 27 a group was noticed in lat. 24° S., while another and more important group in nearly the same latitude was observed during three successive rotations in August, September, and October. Bearing in mind that the mean distance from the equator of all spots in 1888 was scarcely more than 7°, and in the first five months of 1889, but little more than 5°, these outbreaks in high latitudes become very significant ; and taken with the marked increase in number and size of spots during the months of June, July, August, and September, as compared with the earlier part of the year, point to the minimum being definitely passed. If this be so, the period of quiescence has been decidedly shorter, the run down from maximum swifter, and the turn towards recovery sharper than in the preceding cycle. Judging from the form of the spot curve on previous occasions when a short period of minimum has followed a maximum of low intensity, as was that of 1883, we may expect that the revival will be rapid, and the next maximum a strongly marked one.

PROPOSED MEMORIAL OF DR. JOULE.

A PUBLIC meeting was held on Monday in the Mayor's parlour at the Town Hall, Manchester, for the purpose of considering the proposal to erect a memorial of the late Dr. James Prescott Joule. The meeting was convened in response to a memorial influentially signed by residents in Manchester, Salford, and the neighbouring country who desire that the "deep sense of the benefits conferred on mankind for all time, as well as of the great honour which accrues to this district, by the scientific work of the late James Prescott Joule should be marked by the erection of some durable memorial of him in the city." The meeting was very numerously and influentially attended. The Mayor of Manchester presided, and amongst those present were Sir H. E. Roscoe, M.P., Mr. J. W. Maclure, M.P., Dr. Ward (Vice-Chancellor of the Victoria University), Dr. Greenwood (Principal of the Owens College), Prof. Osborne Reynolds, Prof. Munro, Dr. Tatham, Mr. F. J. Faraday, and many others.

A number of letters of apology for absence were read. Lord Derby wrote from London :—

"I cannot attend the meeting on Monday in aid of the Joule memorial, having business here, but I heartily sympathize with the object, and will with pleasure contribute."

Mr. William Mather wrote :—

"When the beautiful simplicity of Dr. Joule's life and character are regarded in conjunction with the world-wide fame his labours have acquired among the greatest intellects of our time, we in Manchester must feel that our late fellow-citizen's memory deserves to be kept ever fresh in our midst by a memorial alike worthy of this city and of the imperishable renown which Dr. Joule has won. Those of us who apply science to industry are deeply indebted for the means through which we work to the original thinkers who put the laws of Nature into our hands with clear definitions as to their purposes. I trust this sense of indebtedness may be felt throughout this district, and that funds may be generously supplied to enable the committee to raise a memorial amply testifying to our gratitude and to our admiration for the late Dr. Joule."

The Bishop of Manchester wrote :—

"I greatly regret that I am prevented by an engagement from attending the meeting in connection with the proposed memorial to Dr. Joule. I think that it would be an honour to any town to be the birthplace and home of the man who first proved the truth of the great principle of the conservation of energy. I most heartily sympathize with the movement which the meeting is called together to initiate, and I shall very gladly give a contribution to any fund which may be to-day established or recommended."

The Mayor, having spoken of the relations between Manchester and science in past times, said the scientific work of Dr. Joule had made the name of Manchester famous throughout the world, not merely as that of a great industrial and trading city, but as a centre of intellectual culture and home of genius. This great man was born in Salford, but he learnt his science as a boy from Dr. Dalton, in George Street in this city. There, he, for a period of nearly half a century, found the congenial society which stimulated his genius. He read many of his papers there ; his experiments were performed in this city ; and to the end he continued to reside in the suburbs, in a quiet and unostentatious way, his riches truly consisting, not in the extent of his possessions, but in the fewness of his wants. The last generation honoured the memory of Dalton by a statue in marble by Chantrey, which was considered to be one of the most beautiful works of art in the city, and it was suggested that they should show their appreciation of Dalton's great successor in a similar way.

Mr. Oliver Heywood moved :—

"That this meeting desires to mark its deep sense of the benefits conferred on mankind for all time, as well as of the great honour which has accrued to this district, by the scientific work of the late James Prescott Joule, by the erection of a durable memorial of him in Manchester, in the form of a white marble statue."

Sir H. E. Roscoe, M.P., said he felt it a pleasure and an honour in more ways than one to be asked to second the resolution, because, in the first place, he was one of the oldest scientific friends of the man whose memory they had met to honour, and because it had been his privilege not only to become acquainted with his important scientific labours, but to enjoy the friendship of one who might truly be said to have been a typical man of science, the simple straightforward searcher after truth for its own sake and that alone. Another reason was a more personal one. On the occasion of his first public utterance in Manchester, now more than thirty-two years ago, when he read his inaugural address on taking up the duties of the Chair of Chemistry in the Owens College, he drew attention to the great work accomplished by Joule. This was, so far as he could learn, the first occasion on which Joule's work and its importance was brought publicly before a Manchester audience, and he remembered as if it were yesterday being asked by several Manchester friends who this Dr. Joule was of whom he had spoken in such high terms, and what was the great discovery he had made. And then he remembered that, after explaining as well as he could to unscientific people the meaning of the mechanical equivalent of heat and the conservation of energy, he added in joke, in order to impress the matter on minds unaccustomed to deal with subjects scientific, that in the good time coming Manchester would be immortalized, not, as they thought, by being the seat of the cotton trade, but rather as being the place where John Dalton worked out the atomic theory of chemistry, and James Prescott Joule placed upon a sure experimental basis the grand principle of the conservation of energy. Since that time many things had happened, many changes had occurred, and the knowledge of Science and her doings was more widespread. We had acknowledged our indebtedness to Dr. Dalton, and we were now met to consider how we could best do the same for Joule. The memorial which had been presented to the Mayor was of itself proof that Manchester was anxious to recognize merit such as that of Dr. Joule, and to acknowledge that services thus quietly and unostentatiously rendered were sometimes of far greater value to the State than those about which much more was heard. This was not the occasion nor was that the place to enter into an elaborate discussion of Joule's scientific labours. It was sufficient now to remember that, just as Lavoisier, more than a century ago, proved the indestructibility of matter, so Joule nearly half a century ago proved the indestructibility of energy—that we could no more destroy or create energy than we could create or destroy matter. And "thereby hangs a tale"—a tale so interesting that it would take long to tell it ; a tale so far-reaching that it concerned every great industry ; a tale so important that without it all the modern applications of scientific discovery to the daily wants of mankind could not have been made. The events which formed the incidents in this tale had happened in our midst, and had taken place so quietly that but few had known of their existence. Like many great discoverers, Joule was far in advance of his time ; and even the results of his most important research, that on the determination of the mechanical equivalent of heat, met with opposition, and were received with incredulity by men who ought to have known better. Indeed, it was an open secret that when Joule's first paper on this subject, an abstract of which had been read at the Cork meeting of the British Association on August 21, 1843, was presented to the Council of the Royal Society for publication in their Transactions, some of the members of that learned body openly expressed their opinion that the paper was nonsense from beginning to end, that the author, who was a mere amateur, living in some remote and rather uncivilized part of the country, out of the charmed circle of metropolitan and professional science, had been entirely mistaken, because he had, forsooth ! neglected the whole question